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Amendment dated 08/18/2003

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01240162aa

The following is a complete listing of all claims in the application, with an indication of the status of each:

Listing of claims:

- 1 1. (currently amended) A method of forming a field effect transistor (FET)
2 transistor, comprising:
3 providing a substrate;
4 forming a layer on the substrate, the layer having ~~a side surface~~
5 exposed side surfaces;
6 forming an epitaxial channel on the ~~side surface~~ each of the exposed
7 side surfaces of the layer, the channel having ~~a an exposed~~ first sidewall
8 opposite the layer;
9 removing a channel on a first side of the layer and then removing the
10 layer, for thereby exposing a second sidewall of the channel formed on the
11 second side of the layer;
12 forming a second channel in place of said removed channel; and
13 forming a gate adjacent to at least one of the sidewalls of the channel
14 and the second channel, there being a gate dielectric between each channel and
15 the gate.
- 1 2. (withdrawn) A field effect transistor (FET) comprising:
2 a substrate;
3 a source region and a drain region in the substrate, each of said source
4 region and said drain region having a top, bottom and at least two side

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5 diffusion surfaces, the source and drain regions separated by an epitaxially
6 grown channel region having a top, bottom and side channel surfaces
7 substantially coplanar with corresponding ones of the diffusion surfaces;
8 a gate adjacent the top and the side channel surfaces and electrically
9 insulated from the top and side channel surfaces; and
10 the gate comprising a planar top surface, the planar top surface having
11 a contact for receiving a gate control voltage for controlling the FET.

1 3. (withdrawn) The FET as recited in claim 2, wherein the source and drain
2 have a contact for receiving a control voltage for controlling the FET.

1 4. (withdrawn) The FET as recited in claim 2, wherein the gate is
2 substantially centered between and substantially parallel to said source region
3 and said drain region.

1 5. (withdrawn) The FET as recited in claim 2, further comprising a silicide
2 layer that contacts a top surface of said gate.

1 6. (withdrawn) The FET as recited in claim 2, further comprising a dielectric
2 layer that contacts a first side end and a second side end of said gate.

1 7. (withdrawn) The FET as recited in claim 2, further comprising a dielectric
2 that contacts side surfaces of the channels.

1 8. (withdrawn) The FET as recited in claims 2, where the gate is comprised
2 of polysilicon.

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- 1 9. (withdrawn) The FET as recited in claim 2, wherein the channel is
2 approximately one fourth of a length of the FET.
- 1 10. (withdrawn) The FET as recited in claim 2, further comprising a
2 dielectric material in the gate for electrically separating the gate into two
3 electrically isolated portions, each having a substantially coplanar top surface
4 and a contact pad on each respective substantially coplanar top surface.
- 1 11. (withdrawn) The FET as recited in claim 2, wherein said epitaxial
2 channel is formed of a combination of Group IV elements.
- 1 12. (withdrawn) The FET as recited in claim 2, wherein said epitaxial
2 channel is formed of an alloy of silicon and a Group IV element.
- 1 13. (withdrawn) The FET as recited in claim 2, wherein said epitaxial
2 channel is formed of an alloy of silicon and at least one of germanium and
3 carbon.
- 1 14. (currently amended) A method for forming a double gated field effect
2 transistor (FET), comprising the steps of:
3 forming on a substrate a first and a second epitaxially grown channels,
4 said channels having side surfaces extending up from the substrate, wherein
5 said second channel is grown following removal of a central semiconductor
6 region upon which said first channel was grown;

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7 etching areas within a silicon layer to form a source and a drain,
8 wherein a side surface of the source and the drain contact opposing end
9 surfaces of the first and second epitaxially grown channels; and
10 forming a gate that contacts a top surface and two side surfaces of the
11 first and second epitaxially grown channels and a top surface of the substrate.

1 15. (currently amended) The method as recited in claim 14, wherein the
2 forming step comprises the steps of:
3 forming first and second semiconductor lines ~~line~~, each end of the
4 silicon lines contacting an end of the source and the drain;
5 forming an etch stop layer on an exposed side surface of each of the
6 first and second semiconductor lines;
7 epitaxially growing first and second semiconductor layers on each etch
8 stop layer;
9 etching away the first and second semiconductor lines and the etch
10 stop layers;
11 filling areas surrounding the first and second epitaxially grown
12 semiconductor layers and between the source and the drain with an oxide fill;
13 and
14 etching a portion of the oxide fill to form an area that defines a gate,
15 wherein the area that defines the gate is substantially centered between and
16 substantially parallel to the source and the drain.

1 16. (original) The method as recited in claim 15, further comprising the steps
2 of:

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3 etching the oxide fill between the gate the source to expose the first
4 and second epitaxially grown silicon layers; and
5 etching the oxide fill between the gate and the drain to expose the first
6 and second epitaxially grown silicon layers.

1 17. (original) The method as recited in claim 16, further comprising the step
2 of forming an oxide on the first and second epitaxially grown silicon layers.

1 18. (original) The method as recited in claim 17, wherein the oxide is silicon
2 dioxide.

1 19. (previously amended) The method as recited in claim 14, further
2 comprising the steps of:
3 implanting a portion of the epitaxially grown silicon layers between
4 the gate and the source; and
5 implanting a portion of the epitaxially grown silicon layers between
6 the gate and the drain.

1 20. (previously amended) The method as recited in claim 19, wherein the
2 implanting step is in the range of 10 to 45 degrees relative to a vector
3 perpendicular to a top surface of the epitaxially grown silicon layers.

1 21. (currently amended) The method as recited in claim step 20, wherein the
2 implants are done in a series at approximately 90 degrees relative to each
3 other.

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1 22. (original) The method as recited in claim 14, further comprising the step
2 of forming a contact on each of the gate, the source and the drain.

1 23. (original) The method as recited in claim 14, wherein the gate material is
2 polysilicon.

1 24. (currently amended) A method of forming an FET, comprising:
2 forming on a substrate a first semiconductor layer having first and
3 second ends and a central region that is thinner than said first and second ends,
4 said central region having first and second side surfaces extending upward
5 from said substrate;
6 epitaxially growing a semiconductor channel region on at least one of
7 said first and second side surfaces of said central region of said first
8 semiconductor layer, a first side of said channel being exposed;
9 removing said central region of said first semiconductor layer, thereby
10 exposing a second side of said channel;
11 forming a dielectric layer on exposed surfaces of said semiconductor
12 channel region; and
13 forming a gate electrode on said dielectric layer.

1 25. (previously presented) The method of claim 24, wherein said
2 semiconductor channel region is formed of a combination of Group IV
3 elements.

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1 26. (currently amended) The method of claim 24, wherein said
2 semiconductor channel region is formed of an alloy of silicon and a Group IV
3 element.

1 27. (previously presented) The method of claim 24, wherein said
2 semiconductor channel region is formed of a material selected from the group
3 consisting of silicon, silicon-germanium, and silicon-germanium-carbon.

1 28. (previously presented) The method of claim 27, wherein said step of
2 removing said first semiconductor layer does not appreciably remove said
3 semiconductor channel region.

1 29. (previously presented) The method of claim 28, wherein an etch stop is
2 epitaxially grown between said first semiconductor layer and said
3 semiconductor channel region.

1 30 (previously presented) The method of claim 24, wherein said gate
2 electrode is formed of a material selected from the group consisting of
3 polysilicon, silicon-germanium, refractory metals, Ir, Al, Ru, Pt, and titanium
4 nitride.

5
with.